Manufacture in town and country before the factory

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Well before the advent of the factory system, wealth in Europe was visible in the form of an immense accumulation of commodities. Richard Steele's engagingly exotic 'Fashionable Inventory', published in *The Tatler* in 1711, presented a range of items–from a 'musk coloured velvet mantle lined with squirrel skins' and a 'silver cheese toaster', to 'seven cakes of superfine Spanish wool, half a dozen of Portugal dishes and a quire of paper from thence' – whose rich detail testifies to the magnitude and diversity of the world of goods available for opulent consumption in metropolitan society in the age of manufacture. Defoe in 1726 described the immense extent of England's inland trade which 'extended in every part of the island'. Almost every manufacturing county of England was employed in making the various components of a suit of clothes consisting of a coat of woollen cloth that came from Yorkshire, a waistcoat of cullamancoe from Norwich, breeches of strong drugget from Devizes and Wiltshire, stockings of yarn from Westmorland, a hat of felt from Leicestershire, gloves of leather from Somerset, shoes from Northampton, buttons from Macclesfield or, if metal, from Birmingham, garters from Manchester, and a shirt of handmade linen from Lancashire or Scotland.[1] How was this wide range and quality of goods made? How was the work of those who produced them perceived and lived? What *was* manufacture without machines? Surprisingly, adequate answers to these questions are likely to be hesitant and tentative.

In many respects, current understanding of manufacture before the advent of factory production is not all that different from the excellent but brief characterisation produced nearly thirty years ago by T. S. Ashton.[2] With a few

1 L. E. Steele (ed.), *The Essays of Richard Steele* (London, 1945), pp. 183–6. The phrase 'the world of goods' is, of course, derived from Mary Douglas and B. Isherwood, *The World of Goods: Towards an Anthropology of Consumption* (London, 1979). Daniel Defoe, *The Complete English Tradesman* (London, 1726), I, 401.

2 T. S. Ashton, *An Economic History of England: The Eighteenth Century* (London, 1955), Ch. VII.

qualifications, his description of the organisation of work in the eighteenth-century English economy remains sufficiently familiar to stand as a model of the general features of manufacture before the advent of mechanised production. Underemployment was the 'normal' condition of labour in town and country; work was irregular and indebtedness the natural result. 'Casual' methods of earning naturally engendered 'casual' habits of living: leisure preference was almost universal. In many trades and branches of manufacture there was a tradition that workers would have a share in the product of their labour. Thus the line separating 'established rights' from 'barefaced robbery' was difficult to draw; there was a close connection between 'long pay' and the embezzlement of materials. The great diversity, both in form and in amount, of workers' payments reflected the fact that it was 'hardly possible to speak of a regional let alone a national market for labour'.

The combination of customary payments, perquisites, irregularity of employment and partially monetised wage systems which Ashton described was indicative of a society in which the medium of exchange was still closely bound to the nature of the direct product of labour and the direct needs of those engaged in production. Money, in other words, mediated many transactions to a limited extent. In this situation, where the social power of the medium of exchange was limited, the power of different kinds of community – trade, family, confraternity, regional or religious affiliation – which might have bound individuals together was the greater. This much is a truism.[3] The implications of that truism are very much more difficult to define.

It is easier to define the development of the system of production before the factory by itemising what was *not* to be found there than it is to understand how that system worked in its own terms. How did the power of the different kinds of 'community' function to ensure that work was carried out? How did these communities establish some degree of continuity in the relationships between those engaged in production – merchants and masters, masters and journeymen, men and women, apprentices and journeymen, adults and children? How, in

3 More recent studies of manufacture in eighteenth-century Britain have added little to the analytical framework outlined by Ashton, although they have added something to our understanding of the nature of custom and convention in certain trades. See, for example, J. G. Rule, *The Experience of Labour in 18th Century Industry* (London, 1981); R. Malcolmson, *Life and Labour in England 1700–1800* (London, 1981); C. R. Dobson, *Masters and Journeymen: A Pre-history of Industrial Relations 1717–1800* (London, 1980). The as yet unpublished work of P. Linebaugh, 'Tyburn: A Study of Crime and the Labouring Poor in 18th Century London', unpublished Ph.D. thesis (University of Warwick, 1975), promises to take matters very much further. With the exception of the work of Pierre Vilar, very few of the classics of recent French historical writing, particularly those associated with the *Annales*, have touched upon manufacture as a substantial analytical problem. See the remarks by M. Morineau in his long review of F. Braudel, *Civilisation materielle, économie et capitalisme*, in *Revue d'Histoire moderne et contemporaine*, XXVIII (1981), 635–6.

other words, did the forms of power implicitly present in the relationship between each and any one of the social partners listed above *work* in an only partially monetised world?[4] It is worth posing this type of question at the outset because it leaves the notion of the economy of the pre-industrial world relatively open.[5] While it would be absurd *not* to examine the economies of pre-industrial societies, it has been only too easy to assume that the word 'economy' has a self-evident meaning in this sort of context. This has happened because a great deal of the discussion of manufacture before the factory has been subordinated to another, traditionally more substantial, question.

For many years, historians have been concerned to explain how and why towards the late eighteenth century, 'mechanisation took command' of the business of producing commodities.[6] In different ways, the terms 'Industrial Revolution', 'industrial system' or 'industrial capitalism' have been used to suggest that a crucial turning-point in the history of production occurred in Britain at a specific time. This emphasis upon the discontinuity symbolised by the factory has ensured that much of the analysis of earlier material systems has centred upon two interrelated questions.

The first of these is a somewhat teleological one concerned with the problem of the origins of the industrial system and, whether presented in the form of 'the transition from feudalism to capitalism', 'the causes of the Industrial Revolution' or 'the origins of the modern world system', it takes a certain definition of the nature of the economy, the market and the factory as both its end and its beginning.[7] Very schematically the procedure adopted usually consists of examining and explaining those forces which contributed to the formation of 'modern' economies, markets and systems of production. The second question centres upon the problem of failures and abortions and, in its turn, follows a procedure designed to explain why in certain times and places the emergence of modern economic systems did not occur.

4 On non-monetised transactions and their analysis in a different context, see P. Bourdieu, *Esquisse d'une théorie de la pratique* (Geneva, 1972) and *Le Sens pratique* (Paris, 1980). More generally, see M. De Certeau (ed.), *L'Invention du quotidien*, 2 vols. (Paris, 1980).

5 On the dangers of anachronism in analysing non-market economies, see K. Tribe, *Genealogies of Capitalism* (London, 1981) and, in the context of the relationship between the seventeenth-century English economy and seventeenth-century theories of property, see J. Tully, 'The Framework of Natural Rights in Locke's Analysis of Property: A Contextual Reconstruction', in A. Parel and T. Flanagan (eds.), *Theories of Property: Aristotle to the Present* (Waterloo, 1979), and *idem, A Discourse on Property* (Cambridge, 1980). Both these inquiries reflect the substantial discussion of historicity and its modes which has taken place among historians of political thought and historians of science over the past fifteen years or so, with fruitful implications for mere historians.

6 The phrase is from S. Giedeion, *Mechanisation Takes Command* (New York and Oxford, 1948).

7 See, for example, R. Hilton (ed.), *The Transition from Feudalism to Capitalism* (London, 1976); R. M. Hartwell (ed.), *The Causes of the Industrial Revolution in England* (London, 1967); I. Wallerstein, *The Modern World System*, 2 vols. (London, 1974 and 1980).

In both cases, the starting-point for the examination of the society, period and material system in question is an assumption that the categories underpinning the analysis of modern economies can be transposed to other and different types of social relationship. Any accusation of simple-minded linearity can be met with the response that sophisticated analysis calls for comparison between successful and unsuccessful types of transition. Yet from this standpoint the fact remains that a greater or lesser quantity of the appropriate ingredients have been common to both successful and unsuccessful cases: home demand or foreign demand, fixed capital or variable capital, skilled labour or unskilled labour, labour surplus or labour deficit, low-quality commodities or high-quality commodities, high transactions costs or low transactions costs, capitalist classes or non-capitalist *rentiers*, integrated markets or regional markets, wage–price differentials or price–interest differentials. The litany is impressive and is a testimony to the variety of accounts which have been produced to explain the Industrial Revolution.[8] In the last analysis, however, the terms of the many conflicting interpretations of the Industrial Revolution have been defined by two key symbols: the machine and the market. The degree of productivity of the former and the size and extent of the latter mark the traditional analytical limits of the economic historians' approach to the phenomenon of 'Industrial Revolution'.[9]

The essays brought together in this volume are, to varying degrees, situated outside of this boundary. Their appearance owes itself to a number of changes in the way in which industry, industrialisation and the transition from feudalism to capitalism have come to be defined. Three of these changes are worth dwelling upon in detail because they have done much to erode the classical boundaries within which the question of industrialisation has been enclosed. They are, firstly, the shift to a slow evolutionary view of capital accumulation and technological change in the process of industrialisation, in which the emphasis is placed as much on changes in the culture and organisation of labour as on mechanical innovation; secondly, the progress of social history; and, thirdly, the theory of proto-industrialisation and the research which it has stimulated. A brief survey of these three areas will indicate the context of debate and inquiry which has provoked the writing of this book.

8 The literature and debates are summarised in D. McCloskey and R. Floud (eds.), *The Economic History of Britain Since 1700*, 2 vols. (Cambridge, 1981), I.

9 The formulation may be rather schematic; for one example, however, see F. Crouzet, 'Essai de construction d'un indice annuel de la production industrielle française au xix^{e} siècle', *Annales, Economies, Sociétés, Civilisations*, 25 (1970), 56–99, where the revolution of 1848 and the war of 1870 are presented as 'facteurs exogènes' to the regular and continuous growth of French industry.

CAPITAL, LABOUR DISCIPLINE AND TECHNOLOGY

Recent research in economic history has questioned the extent of fixed capital formation during the early phases of British industrialisation. This challenge has imposed fundamental revisions upon the traditional image of rapid change, machinery and the factory at the end of the eighteenth century. At the macro-economic level theories of economic growth which stressed a direct relation between levels of capital formation and rates of growth in output have come under fire. English indices suggested, as François Crouzet concluded, that high investment ratios might accompany rapid growth in productivity and income, but this was no proof of any causal relation between the two.[10] Enormous variations in the indices themselves, all of which contain substantial margins of error, make it difficult to accept arguments based only on these.[11] Micro-economic studies indicate, however, that not only was capital formation relatively low during Britain's takeoff, but fixed capital formation was really rather insignificant. The individual experiences of firms and industries in the eighteenth century convey the overriding impression that it was circulating capital which mattered and this was tied up in raw materials, inventories, credit and debt, and wages.

It was short-term capital that was needed and which was indeed available in a whole series of customary, traditional and non-institutional arrangements, so that a primitive banking system and limited long-term finance imposed no brake on expansion. Eighteenth-century businesses existed within a web of credit which supported the complex interchanges of outwork, the purchase of materials and the sale of goods. Small productive units and simple technology as well as ingenuity in economising on capital, even in the advanced cotton industry, made fixed capital formation less than problematic. The original and painstaking research of Chapman[12] on the insurance valuations of cotton factories confirmed the earlier impression of Edwards[13] that the typical mill in the first phases of the factory system tied up less than half the total capital invested. Works by Jenkins and Hudson have indicated that the proportion was even lower in the wool textile sector around the turn of the eighteenth century – possibly as low as one sixth overall but varying greatly up

10 François Crouzet (ed.), *Capital Formation in the Industrial Revolution* (London, 1972), Editor's Introduction.

11 See Charles Feinstein, 'Capital', *Cambridge Economic History of Europe*, Vol. VII, Part I (Cambridge, 1978) for a discussion of the different indices.

12 S. D. Chapman, 'Fixed Capital Formation in the British Cotton Manufacturing Industry', in J. P. P. Higgins and S. Pollard (eds.), *Aspects of Capital Investment in Great Britain 1750–1850* (London, 1971).

13 M. M. Edwards, *The Growth of the British Cotton Trade 1780–1815* (Manchester, 1967).

to around 40% depending on the type of manufacturing concern.[14]

Early machinery was made of wood and constructed by workers themselves. A jenny in 1795 cost £6 and a mule £30; a hand loom in 1811 could be had for £5 and a stocking frame for £15. Even a small steam engine was available for £150 to £200, while large ones cost £500 to £800. And those who could not raise this fixed capital could rely on renting accommodation and/or power, and join a thriving market in second-hand machinery.[15]

Though fixed capital was more prominent in the metal extracting and processing industries, even here – in most of the industry – until the beginning of the nineteenth century fixed capital was comparable in size to annual turnover and was smaller than circulating capital. The birth of that classic symbol of Britain's Industrial Revolution, the steam engine, was, as the recent research of N. von Tunzelman has demonstrated, not nearly so eventful as its later development and application have led us to believe. British industry was still predominantly powered by water at the end of the eighteenth century, and even by 1850 14% of British industry and 9% of the textile industry were still run by water. Relatively cheap Savery and Newcomen engines used on their own or to supplement water power proved a viable alternative to the major fixed expense of a Watt engine until beyond the end of the eighteenth century.[16]

The emergence of a new mode of production with the Industrial Revolution now begs for renewed research into its complex relations with its past. Whence came those customs and traditions which spun the web of credit? What were those unspoken relations between the organisation of work and technological change – relations which made the break with the past so hesitant and yet ultimately so final?

Emphasis on circulating capital and the gradual nature of technological change which was embodied in fixed investment during the period of rapid growth in industrial productivity has shifted the focus of historical analysis to the composition, culture and power relationships of and between those engaged in manufacture, whether as capitalists or as workers. Even the evolution of that symbol of industrialisation, the factory, is increasingly viewed in the light of the changes which it wrought in labour discipline and control rather than in that of its strict association with technological advance. It is a story implying gradual metamorphosis and considerable elements of continuity with the past.

Many historians, ranging from Reinhard Bendix to Sidney Pollard and E. P.

14 D. T. Jenkins, *The West Riding Wool Textile Industry, 1770–1835: A Study in Fixed Capital Formation* (Eddington, 1975); Pat Hudson, 'The Genesis of Industrial Capital in the West Riding Wool Textile Industry 1770–1850', unpublished D. Phil. thesis (University of York, 1981), Ch. 2.

15 F. Crouzet, 'Capital Formation in Great Britain During the Industrial Revolution', in Crouzet (ed.), *Capital Formation*; Peter Mathias (ed.), *The Transformation of England* (London, 1979).

16 N. von Tunzelman, *Steam Power and Industrialisation to 1860* (Oxford, 1978).

Thompson, have looked to the relationship between the discipline of labour and the origins of the factory system.[17] The factory was regarded as the key means of quelling the impetuous and undisciplined work rhythms underlying pre-industrial modes of production. If the factory system has now been analysed in the light of the role it played in organising labour rather than in that of its associations with new technology, there is a sense in which historians have been over-impressed with the new departure it represented. They have too easily accepted the hopeful, but not altogether realistic, comment of contemporaries like Andrew Ure. His oft-cited praise of Richard Arkwright went far to identify the factory with labour discipline:

> The main difficulty did not, to my apprehension, lie so much in the invention of a proper self-acting mechanism for drawing out and twisting cotton into a continuous thread, as in the distribution of the different members of the apparatus into one co-operative body . . . and above all in training human beings to renounce their desultory habits of work, and to identify themselves with the unvarying regularity of the complex automaton. To devise and administer a successful code of factory discipline, suited to the necessities of factory diligence, was the Herculean enterprise, the noble achievement of Arkwright.[18]

Marx himself drew on this in setting out the achievements of modern industry: 'Capital can appropriate to itself all the functions of specification, organisation and control, and perform them independently of labour. It can, therefore, impose its objectives on the labour process . . . Labour serves the machine and not the machine labour.'[19]

Landes, Pollard, Bendix and more recently Marglin and Braverman have all accepted the great superiority of the factory system and the machine as ways of organising labour.[20] But, as other historians have shown, the factory system did not end the sway of the family economy, for in many textile mills in England and in France, not just in the eighteenth century, but late in the nineteenth century, labour recruitment and discipline as well as workers' struggle were mediated through the needs and dynamic of the family-based workforce.[21] Neither did the

17 R. Bendix, *Work and Authority in Industry* (Berkeley, 1974); S. Pollard, 'Factory Discipline in the Industrial Revolution', *Economic History Review*, 2nd Series, 16 (1963–4); E. P. Thompson, 'Time, Work Discipline and Industrial Capitalism', *Past and Present*, 38 (1967), reprinted in M. W. Flinn and T. C. Smout, *Essays in Social History* (Oxford, 1974).

18 Andrew Ure, *The Philosophy of Manufactures* (London, 1835); passage reprinted in M. Berg, *Technology and Toil in Nineteenth Century Britain* (London, 1979), p. 65.

19 Karl Marx, *Capital*, cited in Berg, *Technology and Toil*, p. 5.

20 Stephen Marglin, 'What Bosses Do', in André Gorz, *The Division of Labour* (Atlantic Highlands, N. J., 1976); Harry Braverman, *Labour and Monopoly Capital* (London, 1974).

21 N. J. Smelser, *Social Change in the Industrial Revolution* (London, 1959); M. M. Edwards and R. Lloyd-Jones, 'N. J. Smelser and the Cotton Factory Family: A Reassessment', in N. B. Harte and K. G. Ponting, *Textile History and Economic History: Essays in Honour of Miss Julia de Lacy Mann* (Manchester, 1973); William Reddy, 'Skeins, Scales, Discounts, Steam and Other Objects of Crowd Justice in Early French Textile Mills', *Comparative Studies in Society and*

self-acting machinery which was meant to remove the need for highly skilled mule spinners in fact come anywhere near achieving this.[22] In many other industries, workers adapted their own culture and rhythms of work to new contexts so that the factory never became that capitalist-controlled and utterly rational form of work organisation which many historians and economists have claimed it to be.

Some historians have recognised that other forms of industrial organisation did indeed have their own advantages. Subcontracting, for instance, was, if not a method of management, at least a method of evading management. Under this form of organisation the gap between the raw materials and the finished product was filled not by paid employees arranged in a descending hierarchy, but by contractors to whom the production job was delegated. They hired their own employees, supervised the work process and received a piece-rate from the company. It was a system which not only reduced direct supervisory duties, but also enabled the entrepreneur to share risks, capital and technical knowledge with the subcontractor or his outworkers.[23]

The literature on the origins of labour discipline, anachronistic in its approach though some of it has been, has thus had to ask what motivated labour in the period to work in that desultory, intemperate manner which supposedly needed to be contained and disciplined. All those characteristics bound up in what economists put under the category of 'backward-sloping labour supply curve' need to be analysed in their own right. Some have been described, but few are understood.

If time and money were important to industrial capitalist methods and organisation, did they matter as much before the factory system? From the legions of complaints heard from manufacturers and economic commentators in the eighteenth century, we assume that they did. Time was capital, and profits in the pre-industrial economy were determined by the velocity of circulating capital. Capital was accumulated by reducing the duration that stocks of goods were tied up between stages of the production process and marketing. Yet workers and artisans appear to have failed to acquire a sense of the importance of this time keeping. Saving time might have saved capital, but it did not mean more returns for workers. From the workers' standpoint, time was not money. Hence the widely observed leisure preference. In Adam Smith's words: 'Our ancestors were idle for want of a sufficient encouragement to industry. It is better, says the

History, 21 (1979), 204–13; *idem*, 'Modes de paiement et contrôle du travail dans les filatures de coton en France,1750–1848', *Revue du Nord*, 63 (1981), 135–46; William Lazonick, 'The Subjection of Labour to Capital: The Rise of the Capitalist System', *Review of Radical Political Economy*, 10 (1978); *idem*, 'Industrial Relations and Technical Change: The Case of the Self-Acting Mule', *Cambridge Journal of Economics*, 3 (1979), 231–62.

22 Lazonick, 'Industrial Relations and Technical Change'.

23 Sidney Pollard, *The Genesis of Modern Management* (London, 1965).

proverb, to play for nothing than to work for nothing.'[24] In one sense the wage increases offered were too small to induce any significant increase in effort. But in another, equally important, sense money wages as such were not a dominant part of the pre-industrial workers' economy. Hoskins describes the domestic economy of Wigston manor before the enclosures as one in which most of the life of the peasantry was determined outside the market.[25] Sonenscher's essay reproduced below confirms this impression for the urban trades of Paris, and Hudson's research on the Yorkshire textile industry has shown that non-monetary transactions prevailed as late as the mid nineteenth century.

Working for a set time for a set market wage did not necessarily hold the kind of meaning for a pre-industrial workforce as it did for the masters. The economy of needs and the acquisition of social status within the local community were only partially related to participation in the market and to the accumulation of monetary wealth and commodities. The imposition of industrial discipline had therefore to go hand in hand with the imposition of new needs and definitions of subsistence mediated through the market-place. The wider social implications of the plutocracy which Adam Smith discusses in *The Theory of Moral Sentiments* were fundamental to the new responses required of an industrial workforce. It was thus that a revolution in production methods coincided with the creation of new consumption patterns and the much vaunted 'home market' of the eighteenth century.

There was, in addition, a long tradition of acquiring portions of income in ways other than the wage. The failure to keep time and to respond to wages was associated with the need to engage in a whole series of extra-curricular activities yielding up various forms of non-monetary and monetary income. Industrial discipline could only succeed as these other sources of income started to dry up. Thus the importance of the emergence of restrictions on gleaning, poaching and gathering wood.

A major difficulty with the literature on industrial discipline is that it has taken on the prejudices of contemporaries who complained about the casual licentious lives of the poor. Much of the literature has assumed that there was no pattern, time sense or discipline to the way artisans and agricultural labourers conducted their lives. Thompson compares their casual life-style to that of mothers and housewives.[26] It is true that the latter respond to different rhythms than those dictated by the clock and the working week. Theirs is not, however, a casual life-style; it is one orientated to care for others. The rhythm of life and work of housewives is not just task-orientated; it is governed by a strict day by day and

24 Cited in Peter Mathias, 'Leisure and Wages in Theory and Practice', in Mathias (ed.), *The Transformation of England.*

25 W. G. Hoskins, *The Midland Peasant* (London, 1957).

26 Thompson, 'Time, Work Discipline', p. 55.

week by week time discipline, and continuous thinking of the future. The time discipline of housewives is conditioned by children's demands for feeding, clothing and sleeping, and the maintenance of health and learning. Not only is time disciplined; it is spent on others in different ways, leaving virtually none of it for the housewife to 'waste' on herself. This time discipline of family life has very important implications for the time discipline of the pre-industrial artisan. The rhythms of life of the artisan intersected with the rhythms of domestic life because home was in most cases the place of work. In addition, the working patterns of artisans were confined within the constraints of set delivery times of raw materials, availability of assistants who might have had a different time economy, set dates for markets and fairs, and the time patterns of other social and income-earning activities. Time and discipline did matter before the factory system. They were not measured by minutes and hours, but they were measured all the same.

An understanding of the continuities in labour attitudes and culture during the Industrial Revolution also requires consideration of the extent and importance of technological change before the factory. As historians have played down the significance of the large-scale technological breakthroughs of the Industrial Revolution, we have become more aware that technological change was not confined to new power sources and mechanisation. Attention has been drawn to a whole series of 'intermediate' technical changes, to the new skills, adaptive know-how and innovations in hand technologies which prompted great increases in productivity in apparently craft-dominated spheres. The new significance given to this empirical technical change must now force a reconsideration of earlier technologies which provided the foundations for piecemeal progress.[27] First, however, historians have to dislodge a general assumption of static technologies before the eighteenth century. However primitive these early technologies and however limited their impact beside the great innovations of the late eighteenth and nineteenth centuries, it is still the case they may have had an important effect on the division of labour, the organisation of work and the nature and attitudes of the workforce. But we know virtually nothing of these.

An exemplary and detailed empirical study of the impact of technical change in a pre-industrial manufacture can be found in Myska's study of the Czech iron industry over several centuries.[28] This shows that technical change, however primitive, did lead to a transformation in the structure of ownership, to a change in the situation of the labour force and to new production relations. Myska details how a series of medieval technical changes clustered in the fourteenth

27 See Peter Mathias, 'Skills and the Diffusion of Innovations from Britain in the Eighteenth Century', in Mathias (ed.), *The Transformation of England*, pp. 21–44.

28 Milan Myska, 'Pre-industrial Iron Making in the Czech Lands: The Labour Force and Productive Relations *c.* 1350–1840', *Past and Present*, 82 (February 1979).

century – the shaft, machine hammer and water-power – all changed the organisation of work by introducing a new division of labour between miners, charcoal suppliers and foundrymen. The widespread use of water power over the next centuries made for greater specialisation among iron workers as foundry operations were separated off from hammer operations. The spread of the charcoal blast-furnace between 1600 and 1840 intensified this division of labour, throwing up a series of new trades – smelters, foundrymen, and forge masters. This change in technology, furthermore, created a new scale of demand for fixed capital, and the introduction of continuous process production increased the scale of demand for circulating capital. With this development, ownership of the works shifted from non-aristocratic iron masters to large landowners.

Besides these rather striking technical changes must be placed a whole series of new hand tools and intermediate technologies. One such example is the technology of the hardware trades. Unlike the large-scale techniques of Myska's iron works, those of the hardware trades were known to be those which 'alone... require more force than the arm and tools of the workman could yield... still leaving his skill and experience of head, hand and eye in full exercise'.[29] The earliest working equipment of these trades comprised anvil, hammer, file and grindstone, followed by the lathe, then by rolling mill, stamp, press and drawbench. This was a kind of technology not adapted to continuous process or mass production. Its hallmark was flexibility and application, according to the dictates of artisan skill, to the production of a wide range of different articles. But these new tools also provided the opportunity for extensive subdivision of process and extreme specialisation of product. Stamping was separated from the further divided finishing processes. In eighteenth-century Birmingham there were not only button mould turners, button burnishers and button finishers, but gold and silver button makers, horn button makers and inlaid platina button makers. There was, in fact, an important path of artisan technical change which is often neglected by historians. Technical change took the form of small improvements and adaptations of basic machinery and hand tools. Innovation was often wrapped up in the workman's skill at adaptation.[30] Many such innovations went unpatented, and some were lost to the world when their product passed out of fashion. The Birmingham manufacturers were the archetypal carriers of such a path of technical change. Even in the nineteenth century:

> The secret manufacturers who locked their doors and who led James Drake to complain in 1825 that the tourist trade was endangered by their behaviour were in all probability men who found it easier to withhold their innovations by keeping them dark rather than by the

29 W. Hawkes Smith, *Birmingham and its Vicinity as a Manufacturing and Commercial District* (London, 1836), p. 1.

30 See Mathias, 'Skills and the Diffusion of Innovations'.